EXECUTIVE SUMMARY

Upon the invitation of the Korea Hydro & Nuclear Power Co. (KHNP), a peer review mission on safe long term operation (SALTO) was provided to review programmes / activities of the Wolsong Nuclear Power Plant Unit 1 (further referred as "the plant").

The administrative address of the plant is 260 Naa-ri, Yangnam-myon, Gyeongju-shi Kyongsangbuk-do. The plant is located at the south-eastern coast of the Korean peninsula. The turn-key contract is on design, construction, and initial start-up operation of the plant was awarded to AECL (Canada). Hyundai Engineering & Construction participated in the construction as sub-contractor in the primary system and Dong Ah Construction Industrial in the secondary system. Canatom (Canada) took charge of its architecture engineering. The plant is a pressurized heavy water reactor (PHWR) power plant. Its nuclear steam supply system was supplied by AECL (Canada) and is contained in a pre-stressed concrete building. Its reactor output is 2,061 MWth and electrical output of turbine generator is 678MWe. It uses heavy water as moderator and coolant. Nuclear fuel is bundle-shaped natural uranium and can be loaded and withdrawn during operation. Turbine generator was supplied by Parsons (UK).

The commercial operation of the plant, the first heavy water nuclear power plant in the Republic of Korea attained at initial criticality in November 1982. The unit will be 30 years old in November 2012, reaching its design lifetime. Like many other countries, the licensing period is not granted in the Republic of Korea when the Operating License is issued. However, as the nuclear safety is key concern to the public the operation beyond its design life could not be considered as usual.

The license period of nuclear power plant is not limited under the current legal framework in the Republic of Korea. It is mandatory for the utility to conduct periodic safety review (PSR) for its operating nuclear power plants at the intervals of every ten years and submit PSR reports for regulatory review and approval. The definition of the continued operation (CO) (equivalent to the IAEA term "LTO – long term operation") is stated in Paragraph 4 of Article 36 of the Enforcement Decree of Atomic Energy Safety Act and, under this legal statement, it allows extension of the plant operation beyond its design lifetime. The plant plans to extend its operating life with 10 years until 2022.

The plant is required to perform an LTO assessment to demonstrate the safety of the plant for 40 years of operation. This SALTO mission is in support of and has reviewed details related to this LTO assessment. The scope of the SALTO mission was agreed to and defined in Terms of Reference issued in February 2012. Preparatory meetings were held in September 2011 and February 2012. Further details were specified in preparatory meeting minutes. According to these the review team was organized and is constituted of the IAEA team leader and six external experts covering all disciplines involved in Terms of Reference and Preparatory Meeting Minutes.

The mission reviewed planned, in-progress and completed plant activities related to LTO and ageing management of systems, structures and components (SSCs) important to safety.

The IAEA team found that plans are being prepared and extensive engineering work has been done to review ageing degradation mechanisms, and to review/implement ageing management programmes with the goal of justifying safe continued operation beyond

November 2012 with an operational life time horizon of 40 years. In addition, the team noticed good practices and good performance in areas as follows:

Good Practice

- Procedure for electrolytic capacitor replacement.

Good performance

- Medium voltage cable periodic diagnosis;
- Preventive Maintenance Templates;
- Systematic improvement process of maintenance programmes for CANDU reactors;
- Proactive activities to identify non-safety SSCs failure of which affects safety functions;
- Environmental radiation monitoring vehicle;
- Plant Design Basis Data Management;
- Structure Life Management System (SLMS);
- Well-structured AMP in civil structures and buildings.

Taking into account of the above mentioned points, the team recognized that the plant approach and preparatory work for safe long term operation generally follow international practices.

Nevertheless, the team identified areas for further improvement. Thirteen issues were raised including:

- Definition of lifetime in final safety analysis report (FSAR) for continued operation;
- QA related to documentation and records` keeping for LTO;
- Structure and comprehensiveness of the PSR;
- Scope of the Continued Operation (CO) evaluation;
- Coverage and interfaces of different programmes that manage ageing of SSCs in the scope of the CO evaluation;
- Evaluation of effectiveness of programmes to manage ageing of active subcomponents;
- Operating experience related to vibration fatigue;
- Reactor assembly subcomponents excluded from inspection;
- Insufficient attributes of time limited ageing analysis (TLAA) and environmental qualification (EQ) for motor operated valves (MOV) and cables;
- Seismic fixing of electric/ I&C equipment;
- Preventive actions to minimize and control ageing degradation of reactor building containment;
- Measurement of loss of pre-stress force and corrosion in tendons for reactor building containment;
- Suitability of atmospheric dispersion model for gaseous releases.

A summary of the review was presented to the plant management and Korean Institute of Nuclear Safety (KINS) representatives during an exit meeting held on 7 June 2012. Press release was provided to Korean media by the IAEA Team and the press conference was hold after the exit meeting.

This report includes in Appendix III the Team's detailed recommendations arising from this mission.

FOLLOW-UP MISSION

A follow-up mission was organized during 8–11 April 2014 and the team consisted of one IAEA staff member, three external experts and two observers. Participating experts from Sweden, Japan and Switzerland were members of the original SALTO team in 2012. Two observers from Japan were also members of the follow-up team. The SALTO follow-up report is the original report from the main SALTO mission supplemented with the "counterpart actions" and "follow-up assessment by the IAEA review team". The "counterpart actions" provided in issue sheets` section 4 are reviewed by the follow-up IAEA review team prior to the follow-up mission and confirmed in the field during the visit. "Follow-up Assessment by the IAEA Review Team" is then added in light of the follow-up mission into issue sheets` section 5. The IAEA conclusion is produced in issue sheets` section "Resolution Degree". "Status at follow-up SALTO mission" is prepared by the IAEA team for each review area. This resulting document is therefore an overall report of both the original mission and the follow-up mission.

During the original full-scope SALTO peer review mission in 2012, thirteen issues were defined in six reviewed areas. The follow-up team reviewed the progress in issues solving separately for each of those issues and also separately for each recommendation and suggestion contained in issue sheets.

The team has concluded that the plant performed a significant work to solve those issues but a resolution of several of issues must be still finalized. The resolution degree was determined by the team for each issue sheet separately with results as follows:

- 1 issue - insufficient progress to date;
- 5 issues - satisfactory progress to date;
- 7 issues - issue resolved.